

REMARKS

Further and favorable reconsideration is respectfully requested in view of the foregoing amendments and following remarks.

Claim Amendments

Claims 1 [and 4] have been amended to incorporate the limitations of claim 3 [and 7], and to recite toluene as a solvent. Support for this limitation is found on page 16, line 15 of Applicants' specification. As a result of these amendments, claims 2, 3, 6, 7 and 10-15 have been cancelled, without prejudice.

No new matter has been added to the application by these amendments.

Rejection Under 35 U.S.C. § 112, First Paragraph

The rejection of claims 1-3 under 35 U.S.C. § 112, first paragraph, as being non-enabled, has been rendered moot by the above-discussed claim amendments.

Specifically, the Examiner states that the specification is enabling for the polymethylaluminoxane composition in toluene, but is not enabling for the polymethylaluminoxane composition in any solvent to meet the specified limitations. In order to expedite allowance of the application, Applicants have amended independent claim 1 to recite that toluene is a solvent, in accordance with the Examiner's suggestion.

Accordingly, Applicants respectfully request that the above-rejection be withdrawn.

Consideration After Final Rejection

Although this amendment is presented after final rejection, the Examiner is respectfully requested to enter the amendments and consider the remarks, as they place the application in condition for allowance.

Patentability Arguments

The patentability of the present invention over the disclosure of the reference relied upon by the Examiner in rejecting the claims will be apparent upon consideration of the following remarks.

Rejection Under 35 U.S.C. § 102(b)/ § 103(a)

The rejection of claims 1 and 2 under 35 U.S.C. § 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over Smith et al. (U.S. 5,831,109, hereafter "Smith"), as well as the rejection of claim 3 under 35 U.S.C. § 103(a) as being obvious over Smith, are respectfully traversed.

The Position of the Examiner

The Examiner takes the position that Smith's Examples 2 and 4 demonstrate the preparation of a polymethylaluminoxane (PMAO) composition substantially free of trimethylaluminum (TMAL) by reacting TMAL and benzoic acid in toluene with a catalytic amount of PMAO. The Examiner admits that Smith does not expressly disclose the viscosity of the PMAO prepared from the Examples. However, the Examiner states that in Smith's PMAO preparation process, the reaction between TMAL and benzoic acid is quantitative; therefore the molecular weight of PMAO, which determines the viscosity, can be controlled by varying the ratio of TMAL to benzoic acid. The Examiner further states that the ratios of TMAL/O of benzoic acid in Smith's Examples 2 and 4 are 1.27 and 1.25, respectively, which the Examiner states are about the same as the TMAL/O ratio of 1.26 in Applicant's Example 5. Thus, the Examiner takes the position that one would have expected the viscosity of those examples to inherently meet the limitation of the instant claims.

The Examiner also admits that Smith does not expressly use toluic acid. The Examiner takes the position that it would have been obvious to use any carboxylic acid, such as toluic acid, in the PMAO preparation.

Applicants' Arguments

Applicants respectfully disagree with the Examiner's position for the following reasons.

Initially, Applicants note that claim 3 is not rejected under the 102(b)/103(a) rejection. Accordingly, the incorporation of claim 3 into claim 1 has rendered moot the 102(b)/103(a) rejection. Thus, the following arguments are in response to the rejection under 35 U.S.C. § 103(a).

Examples 2 and 4 of Smith are summarized in Table 1, below.

TABLE 1

	Me ₃ Al	Tol.	PhCOOH	Tol.	PMAO	Al/O ^{*1}	Al Conc. ^{*2}
Ex. 2	2 g 27.75 mmol	3.10 g	1.35 g 11.05 mmol	18.4 g	0.83 g (9 wt%-Al)	1.26	3.25 wt%
Ex. 4	8 g 110.99 mmol	9.51 g	5.40 g 44.22 mmol	None	None	1.25	13.50 wt%

*1: Molar ratio of Me₃Al to O derived from PhCOOH.

*2: Al concentration was calculated on the assumption that only CH₄ gas generated by the reaction was removed.

As pointed out by the Examiner, when only the Al/O ratio is focused on with regard to Examples 2 and 4 of Smith, it appears that they correspond to Example 5 of Applicants' specification. However, PMAO is added in order to accelerate the reaction in Example 2 of Smith. The addition of PMAO may be effective as a reaction accelerator in the MAO synthesis, but may significantly reduce the stability of produced MAO. It is assumed that the added PMAO reduces the stability of MAO by affecting the structure of produced MAO, the molecular weight thereof and the molecular weight distribution.

In other words, even if various MAOs are synthesized in accordance with the system and method of Example 2 of Smith, and those similar to Example 2, and the viscosities thereof are determined, the results revealed and obtained by Applicants cannot be achieved due to the intrinsic deterioration factors. Accordingly, Smith is not relevant to Applicants' invention.

In Example 4 of Smith, the Al concentration in the produced MAO solution is much

higher than that defined in the claims of the present invention. The higher the AI concentration, the higher the viscosity, and the lower the storage stability of MAO. This fact can be understood naturally by persons skilled in the art. Example 4 is different from the MAO formula of the present invention only in AI concentration. In view of this feature, a person of ordinary skill in the art can prepare MAO solutions with different AI concentrations and can obtain the claimed viscosity by appropriately determining the viscosity. However, there is no motivation for a person of ordinary skill in the art to determine the viscosity of solutions. As clearly understood by the Examiner, a skilled person would carry out the determination only when he/she realizes a certain relationship between the viscosity and the stability, and wants to clarify the relationship. This relationship has been discovered only by Applicants. Further, Applicants' invention has been completed not only by determining the viscosity and examining the relationship to the stability, but also by discovered the criticality of the system (that occurs at the viscosity of MAO solution @ 40°C of 2.1×10^{-3} Pa).

Based upon the Office Action, it appears that the Examiner considers that persons of ordinary skill in the art would naturally recognize that a MAO solution with a higher viscosity shows a lower stability. However, Applicants respectfully disagree with this assertion. In order to support Applicants' position, enclosed herewith is a brochure issued by Akzo Nobel Corp., in which PMAO (trade name: PMAO-IP) with a high viscosity of 55 mPa·s at 40°C can provide a high stability for several months at room temperatures (30°C or lower). The viscosity described in Applicants' claims is no more than 2.1 mPa·s. Accordingly, the enclosed brochure shows that a solution with a viscosity 20 times higher than Applicants can have a high stability. This information demonstrates that it is unreasonable to presume that a solution with a higher viscosity shows a low stability. Such a phenomenon presumably depends on the MAO formula, the structure of MAO or the distribution thereof. The MAOs obtained also show high activities.

Applicants have examined the relationship between the viscosity change and stability of MAO solutions, which have not been considered in the prior art, and have newly discovered that the MAO produced under certain conditions shows higher stability, thus leading to the present invention.

For these reasons, the invention of Applicants' claim 1 is clearly patentable over Smith.

Conclusion

Therefore, in view of the foregoing amendments and remarks, it is submitted that each of the grounds of rejection set forth by the Examiner has been overcome, and that the application is in condition for allowance. Such allowance is solicited.

If, after reviewing this Amendment, the Examiner feels there are any issues remaining which must be resolved before the application can be passed to issue, the Examiner is respectfully requested to contact the undersigned by telephone in order to resolve such issues.

Respectfully submitted,

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Polymer Chemicals

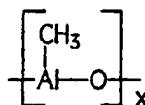
Metal Alkyls

Preliminary data sheet

Polymethylaluminoxane - Improved Performance (PMAO-IP) Toluene Solution

Product description

Formula



CAS Number
TSCA status
EINECS Number

120144-90-3
listed
not established

Characteristics^a

Appearance
Freezing point
Density
Viscosity

Stability to air
Stability to water
Solubility

clear, colorless, viscous liquid
forms glass below 10 °C
0.95 g/mL @ 30 °C
310 mPa·s @ 30 C
55 mPa·s @ 40 C
19 mPa·s @ 50 C
may ignite on exposure
reacts violently
soluble in aromatic hydrocarbons^b

Composition

Component	Specification	Typical
Methane, mol% ^c	96.0 min	98.1
Other alkanes ^c	—	1.9
Aluminum, wt %	13-17	16.1

Availability

PMAO-IP is a new research product, available from Akzo Nobel as 10-gram samples. This product is still under development and may change as a result of ongoing development work.

- a. Data are for PMAO-IP/Toluene Solution containing 16 wt % Al.
b. If lower concentrations are required, PMAO-IP/Toluene Solution should be blended with additional toluene while hot (> 80 °C). Solutions with less than 13 wt % Al may form separate phases on cooling. Such solutions should be used while hot, or immediately after cooling. Blending with aliphatic hydrocarbons may cause precipitation of product.
c. Calculated from hydrolysis gas composition.

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Storage	PMAO-IP/Toluene Solution is stable for up to several months when stored at room temperature (< 30 °C) under a dry, inert atmosphere. Accelerated aging and extended duration stability tests have not been completed. Gelling and/or deposition of solids may occur on standing at elevated temperatures (> 50 °C).
Packaging	PMAO-IP/Toluene Solution is currently packaged in 25 mL glass vials for R&D use only.
Safety and handling	PMAO-IP/Toluene Solution must be handled under an inert atmosphere, such as nitrogen or argon. PMAO-IP/Toluene Solution may ignite on exposure to air and reacts violently with water and other compounds containing active hydrogen. Products of complete combustion of PMAO-IP/Toluene Solution are aluminum oxide, carbon dioxide and water. PMAO-IP/Toluene Solution may cause severe burns to the skin and eyes. Inhalation of toluene may lead to weakness, confusion, impaired coordination, and even death. Please review the material safety data sheet (MSDS) for further information on the safe storage, handling, and use of this product. This information should be thoroughly reviewed before handling this product. Additional information is also provided in the Akzo Nobel brochure on metal alkyls.
Applications	PMAO-IP/Toluene Solution is used as a cocatalyst in the polymerization of α -olefins <i>via</i> single-site catalysts (metallocenes).

All information concerning this product and/or suggestions for handling and use contained herein are offered in good faith and are believed to be reliable. Akzo Nobel Chemicals Inc., however, makes no warranty as to accuracy and/or sufficiency of such information and/or suggestions, as to the product's merchantability or fitness for any particular purpose, or that any suggested use will not infringe any patent. Nothing contained herein shall be construed as granting or extending any license under any patent. Buyer must determine for himself, by preliminary tests or otherwise, the suitability of this product for his purposes. The information contained herein supersedes all previously issued bulletins on the subject matter covered.